
**STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES**

**Oroville Hydroelectric Facilities
Draft Resource Action Development
by Geographic Area**

**OROVILLE FACILITIES RELICENSING
FERC PROJECT NO. 2100**



APRIL 23, 2003

GRAY DAVIS
Governor
State of California

MARY D. NICHOLS
Secretary for Resources
The Resources Agency

THOMAS M. HANNIGAN
Director
Department of Water Resources

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This document was prepared under the direction of

Terry Mills Resource Area Manager, DWR

by

Troy Baker Fisheries Scientist, MWH
Michael Manwaring Senior Engineering Geologist, MWH

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1.0 INTRODUCTION

In order to develop an appropriate settlement alternative, potential Resource Actions need to be identified. Resource Actions associated with Oroville Facilities are expected to undergo NEPA/CEQA evaluation in Summer 2003. Developing Resource Actions is a priority for the Environmental Work Group. The intent of this exercise is to integrate key results and findings to date for the Feather River below the Fish Barrier Dam, the Thermalito Complex and the Oroville Wildlife Area, and Lake Oroville and its upstream tributaries to provide a cohesive environmental picture of the geographic area. At this point in time, much of the data is still unavailable. Available key results were compiled to provide a starting point from which the Environmental Work Group could begin discussion Resource Actions for this geographic area.

The following elements provide essential background for this report:

- **Inclusion of actions in this document at this time does not denote support by any member of the Collaborative.**
- Resource goals listed in this document are taken from goals described at the Environmental Work Group January 21, 2003 meeting.
- In this exercise, we combine the discussion documents and collaborative suggestions from the January 21, February 19, and March 26, 2003 Environmental Work Group meetings. [Comments from the April 23, 2003 meeting will also be incorporated into this document.]
- Discussions with technical resource experts, key results and information released to date, and a review of the study plans were used in this analysis for the geographical study area.
- This document describes the resource issues and potential Resource Actions for the Feather River below the Fish Barrier Dam to the confluence of the Sacramento River, the Thermalito Complex and the Oroville Wildlife Area, and Lake Oroville and its upstream tributaries.

1.1 DESCRIPTION OF RESOURCE AREAS/GOALS/ISSUES

Resource Action development is organized by resource areas, goals, and issues. Resource areas were limited to four environmental areas including: (1) aquatic; (2) terrestrial; (3) water quality; and (4) geomorphology.

Aquatic resource issues include fish passage, aquatic habitat, flow and water temperature, predation, hatchery operations and disease, nutrient transfer and drawdown. Terrestrial resource issues include terrestrial habitat, riparian, non-native plant species, and Threatened and Endangered (T&E) wildlife and plant species. Water quality resource issues include sediment, water temperature and Feather River Hatchery settling ponds. Geomorphology resource issues include drawdown and bank erosion and sediment deposition. No water quality Resource Actions have yet been

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identified for the Oroville Wildlife Area and Lake Oroville. In addition, no geomorphic Resource Actions have been established for the Thermalito Complex. However, additional Resource Actions may be developed within the various geographic reaches, based on the results of current ongoing studies.

2.0 FEATHER RIVER DOWNSTREAM OF THE FISH BARRIER DAM TO THE CONFLUENCE OF THE SACRAMENTO RIVER

2.1 GEOGRAPHIC BASIS FOR DISCUSSION

In addition to structuring by resource area, potential Resource Actions for Oroville Facilities Relicensing is best addressed on a geographic basis. The geographic basis has several advantages: (1) provide consistency with study plans that were developed within a geographic framework; (2) allow integration and evaluation of potential Resource Actions across geographic areas; and (3) cross resource issues can more easily be identified on a geographic basis. The Geographic Units within the Feather River are described below.

2.2 DESCRIPTION OF GEOGRAPHIC UNITS

This effort is directed to the environmental resources downstream of Oroville Dam and reservoir and includes the following:

1. Lower Feather River from the Fish Barrier Dam downstream to the confluence with the Sacramento River.
 - a. Fish Barrier Dam to Thermalito Afterbay Outlet (Low Flow Section)
 - b. Thermalito Afterbay Outlet to Honcut Creek (High Flow Section)
 - c. Honcut Creek to the Yuba River (High Flow Section)
 - d. Yuba River to confluence with the Sacramento River (High Flow Section).

2.3 DISCUSSION OF AQUATIC BIOLOGICAL RESOURCES

2.3.1 LOW-FLOW REACH OF THE FEATHER RIVER

This reach includes the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet

2.3.1.1 Fish Passage

Resource Goals:

1. Minimize and mitigate adverse project related effects on the passage of resident fish (F04)
2. Enhance passage of resident fish (F04)
3. Provide for upstream passage of anadromous fish (F15)

Key Results/Information:

- Flows influence attraction of adult upmigrant anadromous fish, outmigration timing, fish passage, and survival of juvenile and adult fishes in Feather River.
- The Oroville Facilities are operated to meet minimum flows in the Lower Feather River as established by the 1983 agreement. The agreement specifies that Oroville Facilities release a minimum of 600 cfs into the Feather River from the Thermalito Diversion Dam for fisheries purposes. This is the total volume of flows from the diversion dam outlet, diversion dam power plant, and the Feather River Fish Hatchery pipeline.
- No consistent temporal pattern among flow and escapement that might be suggestive of potential flow-related physical impediments to upstream passage of adult salmonids in the low flow section.
- Most steelhead spawning and early rearing occurs at the upstream end of the low flow channel near the Feather River Hatchery, suggesting that fish passage is not limited for steelhead in the low flow section.
- Steep Riffle likely passable for sturgeon and other fish species without complication. This area is located in the lower part of the low flow section.
- Genetic integrity of spring-run and fall-run Chinook salmon in Feather River may be deteriorating because of overlapping spawning areas and lack of physical separation of the two runs in the Feather River (i.e., lack of movement into historical spawning areas due to passage barriers).

Data Available:

- An interim report issued January 2003 on potential sturgeon passage impediments (SP-3.2 Task 3a). This report details sturgeon life history, physical performance parameters for sturgeon, and physical barrier characteristics in the lower Feather River (e.g., Shanghai Bench, Sunset Pumps, and Steep Riffle).
- An interim report issued January 2003 on evaluation of flow-related physical impediments in the Feather River below the Fish Barrier Dam (SP-F10 Task 1c). This report contained an evaluation of impediments for Chinook salmon based on comparison of total Chinook salmon escapement to flow data water year type.
- Interim report issued July 2002 on distribution and habitat use of steelhead and other fishes in the lower Feather River, 1999-2001 (SP-F10, Task 3a).
- Interim report issued July 2002 on literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2).
- Report issued July 2002 on emigration of juvenile Chinook salmon in the Feather River, 1998-2001.

Data Forthcoming:

- Final report for potential Feather River passage impediments expected in Summer 2003 SP-3.2 (Task 3a).
- Final report for SP-F10 Task 1c related to steelhead scheduled for January 2004. This report will describe results of 1st field season and summary of literature

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review of holding habitat characteristics and radio tagging are due in February 2003.

Potential Resource Actions:

- FR-1. Use Fish Barrier Pool for a spring Chinook salmon holding area by adding a fish ladder to the Fish Barrier Dam. This Resource Action would include methods for adult salmon to enter and emigrate from the Fish Barrier Pool and address the lack of spawning habitat currently in the Fish Barrier Pool. This Resource Action may require a new fish ladder or a new section of the fish ladder that is attached to the current Feather River Hatchery ladder.
- FR-2. Install a weir at lower end of low flow section to selectively pass desired fish species into the low-flow reach. A related benefit would be potentially reducing numbers of predators in low flow section. Additional benefits include the segregation of spring and fall-run Chinook salmon and reducing spawning densities in the low flow section of the Feather River.
- FR-3. Use winter-spring high flow pulses (Feb-May) in the low flow section to provide increased migration cues for spring-run salmon, shad, steelhead, sturgeon, splittail, and other desired fish species.

2.3.1.2 Aquatic Habitat

Resource Goals:

1. Enhance habitat for resident aquatic species (F03)
2. Enhance aquatic habitats through alteration of geomorphic processes (F06)
3. Minimize and mitigate adverse project impacts on habitat, genetic integrity and population size of anadromous fishes (F14)
4. Minimize and mitigate project impacts that harm aquatic habitats by altering geomorphic processes or degrading water quality (F06)
5. Minimize and mitigate adverse project effects on regional fisheries and habitat (F12)
6. Minimize and mitigate adverse project-related effects on anadromous fish passage and ecological functions (F15)
7. Minimize or mitigate adverse project related effects on the habitat of resident fish (F03)
8. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)

Key Results/Information:

- No key results have been obtained to date Feather River from modeling efforts or field surveys (SP-F10).
- Some substrate areas in low-flow reach have armoring and winnowing of fines from lack of gravel recruitment.
- Steelhead rearing and spawning occurs primarily in upper end of the low flow section (SP-F10, Task 3A).

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- Juvenile steelhead generally disperse downstream in the low flow section over time. They also grow faster and are generally larger in margin habitats in the low flow section (SP-F10, Task 3A).
- Snorkel and seining surveys indicate most young-of-year steelhead are found in the low flow section compared to the Feather River below the Thermalito Afterbay Outlet (SP-F10, Task 4A).

Data Available:

- Habitat cross-sections for PHABSIM analysis completed (SP-G2).
- Description of life history and habitat requirements of non-salmonid fish species in the Feather River completed (SP-F3.2, Task 2) and (SP-F21, Task 1).
- Report issued August 2002 on distribution of fishes in the lower Feather River in relation to season and temperature, 1997-2001.

Data Forthcoming:

- Habitat analysis completed Summer 2003, will be linked with habitat suitability information (SP-G2).
- Field data collection and specific analyses for splittail, GIS habitat overlays expected Spring 2003 (SP-F3.2, Task 3B).
- Results from numerous tasks in SP-F10 "Evaluation of project effects on salmonids and their habitat in the Feather River below the Fish Barrier Dam" expected May-June 2003.
- SP-F16 will provide data on available habitat suitability for anadromous fish species in June 2003.

Potential Resource Actions:

- FR-4. Add woody debris to the low flow section of the Feather River to increase habitat complexity during juvenile fish rearing for the benefit of salmonids.
- FR-5. Create deep pools in low flow section of Feather River to provide holding habitat for spring Chinook salmon.
- FR-6. Increase quantity of shallow water rearing habitat in the low flow section of Feather River by increasing flows. This Resource Action is designed to increase habitat in the low flow section because increased flows would cover existing riparian vegetation.
- FR-7. Improve or create side-channel habitat for rearing fishes in low flow section of the Feather River.
- FR-8. Increase rearing habitat in side channels via habitat enhancement, design oxbows, or increase gravel mining to provide habitat.
- FR-9. Enhance native riparian vegetation including trees along banks for shading and increased habitat complexity. One location for vegetation enhancement could be trailer park riffle along east side, although drawback is that high-water events may require continued maintenance/improvement of this area.
- FR-10. Supplement existing armored gravel in low-flow reach with suitable spawning gravel to increase productivity (i.e., # fish produced per unit area).

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This option likely would require continued gravel supplementation over time. Spawning gravel could be obtained from the OWA.

2.3.1.3 Hatchery Operations and Disease

Resource Goals:

1. Minimize impact of stocked resident and introduced fish on wild salmonids (F03)
2. Minimize or eliminate adverse project related effects on fish due to diseases within project waters and project affected waters (F09)
3. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)
4. Minimize fish disease through thermal regulation downstream of Oroville Dam (W11)

Key Results/Information:

- Wild fish serve as a natural reservoir for pathogens.
- No evidence to suggest wild disease outbreaks or disease-related wild fish kills occurred in the reach.
- Feather River Hatchery disease outbreaks associated with multiple factors, including water temperature, pathogen presence in waters, and stocking susceptible salmonids above Oroville Dam and the hatchery intake.
- Natural occurrence of pathogens in the Feather River. Minor risk of disease amplification associated with Project if temperature and/or water quality degrades in the low flow section of the Feather River.
- IHN and *C. shasta* most important diseases that require management action in project waters.
- Studies show that Nimbus strain of IHN not transmitted from hatchery to wild fish.
- Although pathogens have been detected in wild fish, no evidence of disease outbreaks in the low flow section of the Feather River.

Data Available:

- Draft final report for effects of project operations on the fish diseases in the project area (SP-F2) completed in February 2003. Final disease report released as information from other reports is finalized.

Data Forthcoming:

- Characterize fish composition and habitat, describe influence of project operations (SP-F3.1).
- Effect of management plans on fish in the project area (SP-F5/7).
- Hatchery effects evaluation (SP-F9) will provide data on Feather River Fish Hatchery operations, cohort analysis, densities in wild, and results of study on virulence of Feather River Type II-strain IHN. Final report will be completed in July 2004.

Potential Resource Actions:

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FR-11. Evaluate all proposed management actions for relevance to fish disease concerns.

FR-12. Decrease hatchery production of salmon so that there is less crowding and competition for limited spawning habitat in the low flow section of the Feather River.

FR-13. Use a weir to restrict access of returning hatchery-origin adults to the low flow section of the Feather River. This Resource Action potentially would reduce genetic introgression between Chinook races and between hatchery/wild salmonids. This Resource Action also would potentially reduce crowding and competition for limited spawning habitat.

2.3.1.4 Predation

Resource Goals:

1. Minimize adverse project impacts that increase predation pressure on salmonids and other species beyond natural or expected rates (F16)

Key Results/Information:

- River lamprey, centrarchids found infrequently in the low flow section of the Feather River, juvenile rearing year-round.
- Striped bass, American shad adults found up to Steep Riffle, primarily during spawning (Striped bass May-June; American shad (May-mid-December).
- Sacramento pikeminnow, Sacramento Sucker, Tule Perch, and hardhead observed year-round (these are resident species) in the low flow section of the Feather River. Tule perch considered infrequent and Sacramento pikeminnow, Sacramento sucker, and hardhead considered frequent in the low flow section of the Feather River.
- Juvenile and adult Chinook salmon and steelhead present in the low flow section of the Feather River.
- High seasonal and annual variations in fish distributions throughout the Feather River.

Data Available:

- Interim report issued January 22, 2003 on distribution and habitat use of steelhead and other fishes in the lower Feather River, 1999-2001 (SP-F10, Task 3a).
- Interim report issued January 22, 2003 on literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2).
- Report issued August 2002 on distribution of fishes in the lower Feather River in relation to season and temperature, 1997-2001.
- Report issued July 2002 on emigration of juvenile Chinook salmon in the Feather River, 1998-2001.

Data Forthcoming:

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- General literature review to identify potential predators of Feather River anadromous salmonids, describe main characteristics of their lifestyle, and identify life history of predators. A final report will be completed by December 2003. (SP-F21, Task 2)
- SP-F21 will produce estimates of salmonid losses to predation based on literature or via models. A final report will be completed by December 2003. (SP-F21, Task 3)
- A review of past and present habitat information related to predators, including cartographic information (aerial photos and topo maps), and data Feather River from water temperature and flow monitoring surveys. Other results Feather River from other study plans will also be incorporated into this study. A final report will be completed by December 2003. Interim report DELAYED as of February 3, 2003. (SP-F21, Task 5)

Potential Resource Actions:

FR-14. Exclusionary devices (e.g., weirs) placed at the lower part of the low flow section have been considered as part of fish passage. Those potential Resource Actions have a potential benefit of reducing predation on salmonids in the low flow section of the Feather River.

2.3.2 HIGH-FLOW REACH OF THE FEATHER RIVER

This reach includes the Feather River below the Thermalito Afterbay Outlet to the confluence of the Sacramento River. The high flow reach is composed of three sections, (1) Thermalito Afterbay Outlet to Honcut Creek, (2) Honcut Creek to Yuba River, and (3) Yuba River to confluence with Sacramento River. Resource Actions have not been proposed to date for the sections of the lower Feather River from Honcut Creek to Yuba River and from Yuba River to the confluence of the Sacramento River. Thus, only potential Resource Actions for the reach from the Thermalito Afterbay Outlet to Honcut Creek are presented below. [Should we have #2 & #3 placeholders?]

2.3.2.1 High Flow Section of the Feather River between the Thermalito Afterbay Outlet to Honcut Creek

Fish Passage

Resource Goals:

1. Minimize and mitigate adverse project related effects on the passage of resident fish (F04)
2. Enhance passage of resident fish (F04)
3. Provide for upstream passage of anadromous fish (F15)

Key Results/Information:

- Flows influence attraction of adult upmigrant anadromous fish, outmigration timing, fish passage, and survival of juvenile and adult fishes in Feather River.
- The 1983 agreement: (1) establishes minimum flows between Thermalito Afterbay Outlet and Verona which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period, except for flood management, failures, etc.; (3) requires flow stability during the peak of the fall-run Chinook spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.
- Rapid water releases from Oroville Dam and subsequent flow changes in the lower Feather River could impact fish movement and/or migration.
- No consistent temporal pattern among flow and escapement that might be suggestive of potential flow-related physical impediments to upstream passage of adult salmonids.
- Under low flow conditions, Shanghai Bench and Sunset Pumps may be impassable for some fishes, including green sturgeon and Sacramento splittail due to water velocities in some areas and vertical height barrier.

Data Available:

- Interim report issued January 2003 on distribution and habitat use of steelhead and other fishes in the lower Feather River, 1999-2001 (SP-F10 Task 3a).
- Interim report issued January 2003 on literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2).
- An interim report issued January 2003 on evaluation of flow-related physical impediments in the Feather River below the Fish Barrier Dam (SP-F10 Task 1c). This report contained an evaluation of impediments for Chinook salmon based on comparison of total Chinook salmon escapement to flow data water year type.
- Report issued July 2002 on emigration of juvenile Chinook salmon in the Feather River, 1998-2001.

Data Forthcoming:

- Final report for passage impediments (SP-F3.2 Task 3a) expected in Summer 2003.
- Final report for SP-F10 Task 1c scheduled for January 2004.
- Final report for SP-F10 Task 3a scheduled for December 2003.
- SP-F10 will provide data on salmonids and their habitat in the Feather River.
- SP-21 will provide information on predator/prey relationships and potential habitat considerations.

Potential Resource Actions:

- FR-15. Provide additional flows from the Thermalito Afterbay Outlet to the high flow section of the Feather River to provide productive habitat (off channel areas,

floodplains) and encourage upstream migration of native adult fishes (salmon, sturgeon, splittail, shad, etc).

FR-16. Structurally modify the Sunset Pumps area to aid passage of green sturgeon and splittail. This Resource Action may involve investigating flow velocity suitability or gradient changes at Sunset Pumps for fish passage; reduce flow velocities at Sunset Pumps as necessary to allow for the splittail, green sturgeon, or other desired fish species to pass.

FR-17. Modify Shanghai Bench to aid passage of splittail and sturgeon or other desired fish species.

FR-18. Re-condition the existing benches along the lower Feather River reach to improve fisheries conditions.

FR-19. Assist in field calibration of sturgeon passage information from University California-Davis studies (conducted in lab in 2003).

FR-20. Conduct field-tracking studies to determine timing and movement patterns of sturgeon in Feather River (i.e., field-verify whether passage is indeed limiting).

FR-21. Provide attraction flows to encourage upstream migration of native anadromous fishes. Also to allow passage over barriers in lower Feather River.

Aquatic Habitat

Resource Goals:

1. Enhance habitat for resident aquatic species (F03)
2. Enhance aquatic habitats through alteration of geomorphic processes (F06)
3. Minimize and mitigate adverse project impacts on habitat, genetic integrity and population size of anadromous fishes (F14)
4. Minimize and mitigate project impacts that harm aquatic habitats by altering geomorphic processes or degrading water quality (F06)
5. Minimize and mitigate adverse project effects on regional fisheries and habitat (F12)
6. Minimize and mitigate adverse project-related effects on anadromous fish passage and ecological functions (F15)
7. Minimize or mitigate adverse project related effects on the habitat of resident fish (F03)
8. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)

Key Results/Information:

- Lack of off-channel habitat has been hypothesized to negatively affect the abundance and distribution of salmonids and other fishes in the Feather River reach below the Afterbay Outlet.
- Spawning habitat quality may be reduced due to armoring and winnowing of fines resulting from lack of gravel recruitment.

Data Available:

- Interim report issued January 22, 2003 on distribution and habitat use of steelhead and other fishes in the lower Feather River, 1999-2001 (SP-F10 Task 3a). The report sought to identify factors potentially limiting steelhead success in the lower Feather River and described the characteristics of natural-origin steelhead in the reach. Multi-scale snorkeling and seining surveys were used to collect data.
- Final report for effects of fisheries management plans on a balanced fishery (SP-F5) is scheduled for Fall 2003.
- Report issued July 2002 on emigration of juvenile Chinook salmon in the Feather River, 1998-2001.
- Report issued August 2002 on distribution of fishes in the lower Feather River in relation to season and temperature, 1997-2001.

Data Forthcoming:

- Final report for effects of existing and future project operations on fish and aquatic resources (SP-F1) scheduled for June 2004.
- Final report for SP-F10 Task 1c scheduled for January 2004.
- Final report for SP-F10 Task 3a scheduled for December 2003.
- General literature review to identify potential predators of Feather River anadromous salmonids, and describe main characteristics of their life history. A final report will be completed by December 2003 (SP-F21, Task 2).
- Produce estimates of losses to predation based on other experiments or model. A final report will be completed by December 2003 (SP-F21, Task 3).

Potential Resource Actions:

- FR-22. Build “benches” at various stages along the reach to ensure that splittail and green sturgeon always have usable habitat (similar to FR-18).
- FR-23. Add woody debris to the low flow section of the Feather River to increase habitat complexity during juvenile fish rearing for the benefit of salmonids.
- FR-24. Increase quantity of shallow water rearing habitat in the high flow section of Feather River by producing higher flows. This Resource Action is designed to increase habitat in the low flow section because increased flows would cover existing riparian vegetation.
- FR-25. Increase connectivity between river channel and lateral habitats (including side channels) in lower Feather River by removing levees to create seasonal habitats for salmon, splittail and other fishes.
- FR-26. Provide winter-spring (February-May) longer duration water pulses to restore geomorphic process (sediment transport), improve spawning habitat, and inundate floodplains to provide high quality rearing habitat. This Resource Action would provide higher flows, which would increase quantity of rearing habitat.
- FR-27. Purchase property adjacent to the Feather River with suitable substrates and dedicate these habitats for permanent juvenile fish nursery areas.

FR-28. Provide additional floodplain habitats adjacent to the river channel from additional water releases from the Thermalito Afterbay Outlet.

Flow and Water Temperature

Resource Goals:

1. Minimize and mitigate adverse project related effects on fish and aquatic resources (F01)
2. Minimize and mitigate adverse project effects on the physical, chemical, and biological integrity of water in Oroville Reservoir, its tributaries, and the Feather River (W03)
3. Ensure factors controllable by the project sustain the physical, chemical, and biological integrity of water in Oroville Reservoir, its tributaries, and the Feather River (W03)
4. Minimize fish disease through thermal regulation downstream from Oroville Dam (W11)
5. Ensure that water temperatures downstream from Oroville Dam are suitable for all beneficial uses during all hydrologic conditions (W12)
6. Maintain suitable water quality for beneficial uses in the Feather River downstream from the hatchery (W13)
7. Minimize and mitigate adverse project effects on water quality and temperature due to pump-back operations (W14)
8. Maintain suitable water quality and temperatures for fish and other aquatic resources in project waters (W14)

Key Results/Information:

- The lower Feather River below the Afterbay Outlet can undergo rapid flow changes associated with Project operations. For example, in mid-February 2003, flows in the lower section changed from 1,250 cfs to >8,000 cfs within 24 hours. This has the potential to negatively impact fish resources.

Data Available:

- Report issued August 2002 on distribution of fishes in the lower Feather River in relation to season and temperature, 1997-2001.
- Report issued July 2002 on emigration of juvenile Chinook salmon in the Feather River, 1998-2001.

Data Forthcoming:

- Interim report issued January 22, 2003 on evaluation of flow-related physical impediments in the Feather River below the Fish Barrier Dam (SP-F10 Task 1c). Evaluation of impediments for Chinook salmon based on comparison of total Chinook salmon escapement to flow data water year type.

- Interim report including analysis of 1st year of field data plus reviews and evaluations of existing data for SP-F10 (Task 2A-D) will be completed in June 2003.
- Interim report for redd dewatering for SP-F10 (Task 2A-D) will be completed in July 2003.
- Phase 1 report for evaluation of project effects on instream flows and fish habitat scheduled for June 2003.

Potential Resource Actions:

FR-29. Use winter-spring high flow pulses (Feb-May) as cues to enhance upstream migration of spring-run Chinook salmon, shad, steelhead, sturgeon, and splittail.

Hatchery Operations and Disease

Resource Goals:

1. Minimize impact of stocked resident and introduced fish on wild salmonids (F03)
2. Minimize or eliminate adverse project related effects on fish due to diseases within project waters and project affected waters (F09)
3. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)
4. Minimize fish disease through thermal regulation downstream of Oroville Dam (W11)

Key Results/Information:

- Wild fish serve as a natural reservoir for pathogens.
- No evidence to suggest wild disease outbreaks in native fisheries or disease-related wild fish kills in native fisheries occurred in this reach.
- Feather River Fish Hatchery disease outbreaks associated with multiple factors, including water temperature, pathogen presence in waters, and stocking susceptible salmonids above Oroville Dam and the hatchery intake.
- Natural occurrence of pathogens in Feather River. Minor risk of disease amplification associated with Project if temperature and/or water quality degrades in Feather River.
- IHN and *C. shasta* most important diseases that require management action in project waters.
- Studies show that the Nimbus strain of IHN not transmitted from hatchery to wild fish.
- Although pathogens have been detected in wild, no evidence of disease outbreaks in Feather River.

Data Available:

- Draft of final report for effects of project operations on the fish diseases in the project area (SP-F2) completed in February 2003. Final disease report released as information from other reports is finalized.

Data Forthcoming:

- Characterize fish composition and habitat, describe influence of project operations at the Oroville Wildlife Area (SP-F3.1 Task 5).
- Effect of management planes on fish in the project area (SP-F5/7). Hatchery effects evaluation (SP-F9) will provide data on Feather River Fish Hatchery operations, cohort analysis, densities in wild, and results of study on virulence of Feather River Type II-strain IHN. Final report will be completed in July 2004.

Potential Resource Actions:

- FR-30. Release hatchery steelhead at a smaller size or alter release timing so they do not present a predation problem for wild salmonids.
- FR-31. Decrease hatchery production of salmon so that there is less crowding and competition for limited spawning habitat in the Feather River.
- FR-32. Use a weir to restrict access of hatchery fish to parts of the Feather River. This Resource Action would reduce genetic introgression between races and between hatchery/wild salmonids. This Resource Action also would reduce crowding and competition for limited spawning habitat.

2.4 DISCUSSION OF TERRESTRIAL RESOURCES

2.4.1 LOW-FLOW REACH OF THE FEATHER RIVER

This reach includes the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet.

2.4.1.1 Terrestrial Habitat

Resource Goals:

1. Development of coordinated interagency wildlife management plan(s) for lands within the project boundary which promote wildlife species diversity, population of sensitive wildlife species, and recreationally/commercially important species (T06)
2. Minimize negative impacts to wildlife habitat through fire and fuel load management practices to enhance public safety (sensitive to wildlife habitat) (T11)
3. Enhance upland habitat on project lands (T10)
4. Minimize and mitigate project-related effects on upland habitat (T05)
5. Enhance riparian and wetland habitats including floodplain and upland wetlands, vernal pools, and brood ponds within the project boundary (T05)

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6. Restore disturbed sites with native plant communities (T07)
7. Minimize and mitigate adverse project-related effects on levee bound floodplain and soil stability, wildlife habitat, native plant communities and project water fluctuation (T03)
8. Minimize and mitigate project-related recreation impacts on wildlife and plant communities (T09)
9. Enhance nesting and wintering Pacific Flyway waterfowl and plant communities (T09)
10. Identify fire prevention management practices to help reduce damage from fires to natural and man-made resources and enhance habitat diversity (T11)

Key Results/Information

- Likely minor impacts movement of wildlife due to recreation.

Data Available:

- No final results available at this time.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.

Potential Resource Actions:

- FR-33. Increase quantity of shallow water rearing habitat in the low flow section of Feather River from higher flows. This Resource Action is designed to increase habitat in the low flow section because increased flows would cover existing riparian vegetation.
- FR-34. Increase rearing habitat in side channels via habitat enhancement.
- FR-35. Enhance native riparian vegetation including trees along banks for shading and increased habitat complexity in the low flow section of the Feather River. One location for native vegetation enhancement could be trailer park riffle along east side, although drawback is that high-water events may require continued maintenance/improvement of this habitat.
- FR-36. Modify recreational use patterns in the Feather River reach to minimize impacts to important terrestrial species (exact measures dependent on analysis in upcoming report).

2.4.1.2 Non-Native Plant Species

Resource Goals:

1. Minimize and mitigate project-related effects on the dispersal of noxious weeds (T07)
2. Incorporate project lands in countywide mapping process of noxious weeds (T07)
3. Control noxious weeds of greatest ecological and agricultural concern (T07)
4. Remove undesirable non-native plant species around lake, river, forebay, and afterbay areas, especially star thistle, tree of heaven, and other invasive plant species (T07)
5. Restore disturbed sites with native plant communities (T07)

Key Results/Information

- Tree of heaven and scarlet wysteria present in the low flow section of the Feather River reach.

Data Available:

- No final results are available at this time.

Data Forthcoming:

- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T7 will provide maps of the current distribution of noxious species in the project area. A report is scheduled for release in Fall 2003.
- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

Potential Resource Actions:

- FR-37. Eliminate noxious plants via mechanical or herbicidal treatment (may require continued maintenance due to periodic high-flow events). Other techniques not mentioned may also be used to control noxious plants.

2.4.1.3 Threatened and Endangered Wildlife and Plant Species

Resource Goals:

1. Enhance wildlife and wildlife habitat within the FERC project boundary (T01)
2. Minimize and mitigate project-related impacts on wildlife and wildlife habitat (T01)
3. Minimize and mitigate adverse project effects on special status plant and animal species (T02)
4. Promote the expansion of sensitive species (T02)
5. Minimize and mitigate adverse project-related effects on riparian and wetland ecosystems along the Feather River (T05)
6. Enhance vegetation and wildlife habitat within the levee bound floodplain and project water fluctuation zone (T03)
7. Minimize and mitigate adverse project-related effects on plant and wildlife species diversity (T04)
8. Maintain viable populations of all native species with emphasis on sensitive species (T04)
9. Maintain viable populations of desirable non-native animal species (T04)
10. Minimize and mitigate adverse project-related effects on biodiversity and ecosystem health (T04)
11. Enhance biodiversity and ecosystem health and stability (T04)

Key Results/Information:

- Presence of Western Yellow-billed Cuckoo and Valley Elderberry Longhorn Beetle.
- Potential to affect special status wildlife, although species yet to be determined.

Data Available:

- No final results are available at this time.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.

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- SP-T7 will provide maps of the current distribution of noxious species in the project area. A report is scheduled for release in Fall 2003.
- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

Potential Resource Actions:

FR-38. Enhance or add riparian habitat for threatened and endangered species in the low flow section of the Feather River. At this time, this Resource Action is not specific to locations within the low flow section of the Feather River or species that would be involved in riparian enhancement (may require continued maintenance due to periodic high-flow events). The addition of riparian habitat may require land acquisition.

2.4.2 HIGH-FLOW REACH OF THE FEATHER RIVER

This reach includes the Feather River below the Thermalito Afterbay Outlet to the confluence of the Sacramento River. The high flow reach is composed of three sections, (1) Thermalito Afterbay Outlet to Honcut Creek, (2) Honcut Creek to Yuba River, and (3) Yuba River to confluence with Sacramento River. Resource Actions have not been proposed to date for the sections of the lower Feather River from Honcut Creek to Yuba River and from Yuba River to the confluence of the Sacramento River. Thus, only potential Resource Actions for the reach from the Thermalito Afterbay Outlet to Honcut Creek are presented below. [Include placeholders?]

2.4.2.1 Riparian

Resource Goals:

1. Minimize and mitigate adverse project related effects on riparian and wetland ecosystems along the Feather River (T05)
2. Enhance riparian and wetland habitats including floodplain and upland wetlands, vernal pools, and brood ponds within the project boundary (T05)

Key Results/Information:

- Diversity of riparian habitats along the Feather River downstream from the Thermalito Afterbay Outlet to Honcut Creek.

Data Available:

- Final results are not available at this time.

Data Forthcoming:

- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland

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communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.

- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.

Potential Resource Actions:

- FR-39. Develop a hydrologic regime to support natural regeneration of native riparian vegetation along the high flow section of the Feather River between the Afterbay Outlet and Honcut Creek.

2.4.2.2 Terrestrial Habitat

Resource Goals:

1. Development of coordinated interagency wildlife management plan(s) for lands within the project boundary which promote wildlife species diversity, population of sensitive wildlife species, and recreationally/commercially important species (T06)
2. Minimize negative impacts to wildlife habitat through fire and fuel load management practices to enhance public safety (sensitive to wildlife habitat) (T11)
3. Enhance upland habitat on project lands (T10)
4. Minimize and mitigate project-related effects on upland habitat (T05)
5. Enhance riparian and wetland habitats including floodplain and upland wetlands, vernal pools, and brood ponds within the project boundary (T05)
6. Restore disturbed sites with native plant communities (T07)
7. Minimize and mitigate adverse project-related effects on levee bound floodplain and soil stability, wildlife habitat, native plant communities and project water fluctuation (T03)
8. Minimize and mitigate project-related recreation impacts on wildlife and plant communities (T09)
9. Enhance nesting and wintering Pacific Flyway waterfowl and plant communities (T09)
10. Identify fire prevention management practices to help reduce damage from fires to natural and man-made resources and enhance habitat diversity (T11)

Key Results/Information:

- Likely minor impacts on the movement of wildlife due to recreation.

Data Available:

- Final results are not available at this time.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T6 will generate a wildlife management plan for lands within the Project area
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.
- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

Potential Resource Actions:

- FR-40. Modify recreational use patterns in Feather River reach to minimize impacts to important native terrestrial species (exact measures dependent on analysis in upcoming report).
- FR-41. Provide improved native vegetation cover and screening within important corridors (exact measures dependent on analysis in upcoming report).

2.4.2.3 Non-Native Plant Species

Resource Goals:

1. Minimize and mitigate project-related effects on the dispersal of noxious weeds (T07)
2. Incorporate project lands in countywide mapping process of noxious weeds (T07)
3. Control noxious weeds of greatest ecological and agricultural concern (T07)
4. Remove undesirable non-native plant species around Lake Oroville, Feather River, Thermalito Forebay, and Thermalito Afterbay areas, especially star thistle, ailanthus, and other invasive plant species (T07)
5. Restore disturbed sites with native plant communities (T07)

Key Results/Information:

- Tree of heaven, scarlet wysteria, and giant reed are present in this Feather River reach between the Thermalito Afterbay Outlet and Honcut Creek.

Data Available:

- Final results are not available at this time.

Data Forthcoming:

- SP-T7 will provide maps of current distribution of noxious species.

Potential Resource Actions:

FR-42. Eliminate noxious plants via herbicidal treatment or mechanical control (may require continued maintenance due to periodic high-flow events). Other techniques not mentioned also may be used to control noxious plants.

FR-43. Develop construction and recreational management protocols to control the spread of noxious species.

FR-44. Develop flow regimes to manage establishment of noxious species.

2.4.2.4 Threatened and Endangered Wildlife and Plant Species

Resource Goals:

1. Enhance wildlife and wildlife habitat within the FERC project boundary (T01)
2. Minimize and mitigate project-related impacts on wildlife and wildlife habitat (T01)
3. Minimize and mitigate adverse project effects on special status plant and animal species (T02)
4. Promote the expansion of sensitive species (T02)
5. Minimize and mitigate adverse project-related effects on riparian and wetland ecosystems along the Feather River (T05)
6. Enhance vegetation and wildlife habitat within the levee bound floodplain and project water fluctuation zone (T03)
7. Minimize and mitigate adverse project-related effects on plant and wildlife species diversity (T04)
8. Maintain viable populations of all native species with emphasis on sensitive species (T04)
9. Maintain viable populations of desirable non-native animal species (T04)
10. Minimize and mitigate adverse project-related effects on biodiversity and ecosystem health (T04)
11. Enhance biodiversity and ecosystem health and stability (T04)

Key Results/Information:

- Presence of western yellow-billed cuckoo (potentially), valley elderberry longhorn beetle (VELB), Swanson's hawk, and bank swallow.
- Potential to affect other special status plant or wildlife species, although species yet to be determined.

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Data Available:

- Interim report on SP-T2 released in January 2003 includes reports of wildlife survey conducted in 2002.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.

Potential Resource Actions:

- FR-45. Develop maintenance and recreational management protocols to avoid impact to special status species in the high flow reach of the Feather River between the Afterbay Outlet and Honcut Creek.

2.5 DISCUSSION OF WATER QUALITY

2.5.1 LOW-FLOW REACH OF THE FEATHER RIVER

This reach includes the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet.

2.5.1.1 Water Temperature

Resource Goals:

1. Minimize and mitigate adverse project effects on water quality to protect all beneficial uses (W01)
2. Ensure project related activities maintain or improve water quality to protect beneficial uses and meet or exceed State and other applicable objectives, goals, and criteria (W01)
3. Minimize and mitigate adverse project effects on water quality (W02)
4. Ensure that water quality factors controllable by the project comply with Basin Plan objectives (W02)
5. Minimize and mitigate adverse project effects on the physical, chemical, and biological integrity of water in Oroville Reservoir, its tributaries, and the Feather River (W03)
6. Ensure factors controllable by the project sustain the physical, chemical, and biological integrity of water in Oroville Reservoir, its tributaries, and the Feather River (W03)
7. Minimize and mitigate adverse effects of project operations, facilities, and recreation features on water quality (W04)

8. Enhance water quality to the extent possible with project operations to protect beneficial uses (W04)
9. Operate project related recreational facilities and activities to protect suitability of project waters for all beneficial uses (W05)
10. Adequate facilities and measures for safe handling of sanitary and commercial wastes from residential or commercial developments adjacent to project waters (W05)
11. Minimize project effects, to the extent possible, upon bioaccumulation in the aquatic food chain of metals and other toxic contaminants (W06)
12. Minimize and mitigate adverse project related land management activities on water quality, slope stability, erosion, sedimentation, channel stability, riparian habitat, fish habitat, and other beneficial uses (W07)
13. Protect riparian areas and water quality by limiting disturbance in streamside management zones according to ground slope and stability, stream class, channel stability, fishery, and other beneficial uses (W07)
14. Avoid water quality degradation by using Best Management Practices during land management activities (W07)
15. Reduce sedimentation and channel erosion by rehabilitating deteriorating watersheds (W07)
16. Minimize and mitigate adverse project effects on natural hydrology (W08)
17. Restore more natural hydrograph to the extent possible consistent with project purposes (W08)
18. Minimize and mitigate adverse project effects on water temperatures needed to protect beneficial uses (W09)
19. Maintain suitable water temperatures in waters affected by the project to protect beneficial uses (W09)
20. Minimize and mitigate adverse project effects on water temperatures needed to protect beneficial uses (W10)
21. Maintain suitable water temperatures in waters affected by the project to protect beneficial uses (W10)
22. Minimize and mitigate adverse project impacts on water temperatures (W11)
23. Ensure that water temperatures downstream from Oroville Dam are suitable for all beneficial uses designated in the Basin Plan (W11)
24. Minimize fish disease through thermal regulation downstream from Oroville Dam (W11)
25. Minimize and mitigate adverse project impacts on availability of cold water required for certain beneficial uses (W12)
26. Ensure that water temperatures downstream from Oroville Dam are suitable for all beneficial uses during all hydrologic conditions (W12)
27. Minimize effects of project related hatchery operations on water quality and temperature in project waters (W13)
28. Ensure suitable water temperatures for salmonids in both the Feather River Hatchery and low flow section of the Feather River (W13)

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29. Maintain suitable water quality for beneficial uses in the Feather River downstream from the hatchery (W13)
30. Minimize and mitigate adverse project effects on water quality and temperature due to pump-back operations (W14)
31. Maintain suitable water quality and temperatures for fish and other aquatic resources in project waters (W14)
32. Minimize and mitigate adverse cumulative effects of project on water quality (W16)
33. Maintain water quality in the Feather and Sacramento rivers (W16)
34. Minimize adverse project effects on groundwater movement, quality and level (W17)
35. Minimize and mitigate adverse project effects on natural protective processes (W18)
36. Enhance natural processes for maintaining water quality (W18)

Key Results/Information:

- Increasing water temperatures in the low flow section of the Feather River to benefit agriculture likely has negative impacts to fisheries resources and potentially water quality in the reach.
- Data will be collected and compared with the criteria for beneficial uses identified in the Basin Plan.

Data Available:

- Quarterly progress reports associated with SP-W1.

Data Forthcoming:

- Interim water quality report scheduled for release in April 2003. This report will contain information on water temperature for eight sites in low flow section. Final report due in 2004.

Potential Resource Actions:

- FR-46. Operate the Thermalito Complex to provide colder water to Lower Feather River for the benefit of salmonids.

2.5.1.2 Feather River Hatchery Settling Ponds

Key Results/Information:

- Survival/growth studies indicate “transient” hits during toxicity screening for fish near Fish Hatchery.
- Hatchery settling ponds supposed to hold water for evaporation, but water leaches through cobble pile.
- There is high connectivity between the settling ponds and the Feather River.
- The existing gravel substrate of the settling ponds provides a small amount of filtration.

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Data Available:

- Quarterly progress reports associated with SP-W1.

Data Forthcoming:

- SP-F9 focuses on impacts of hatchery operations on naturally-spawning salmon and includes several tasks, such as describing the Feather River Hatchery facilities and operations and estimating the Feather River Hatchery contribution to in-river and hatchery spawning salmonid populations. These data are expected to provide further information on the point-source inputs. Task reports are scheduled for completion in Spring 2003.
- Final report of hatchery study is due by early-summer 2004 (SP-F9).
- Interim water quality report scheduled for release in April 2003. This report will contain information on water temperature, toxicity, pesticides, bacteria, and inorganic chemistry of water for 8 sites in low-flow reach. These sites are labeled Site 21-28 in SP-W1. Final report due in 2004.

Potential PM&E Measures:

- FR-47 Relocate site for hatchery settling ponds or construct new, functional ponds.
- FR-48. Line existing settling pond with impermeable barrier to prevent leaching.
- FR-49. Assuming further toxic screening indicates problems, post “no swim” or “don’t eat fish” warnings anywhere that tissue and/or sediment results suggest problems may be present.

2.6 DISCUSSION OF GEOMORPHOLOGY

2.6.1 LOW-FLOW REACH OF THE FEATHER RIVER

This reach includes the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet.

2.6.1.1 Sediment

Resource Goals:

1. Minimize and mitigate adverse project impacts to the extent feasible on natural geomorphic processes in the downstream reaches (G01)
2. Maintain and enhance or increase aquatic and terrestrial habitat (G01)
3. Minimize project impacts on the erosion of downstream properties and resources of statewide significance (as defined in CEQA) (G01)
4. Maintain channel design capacity and reduce the risk of flooding (G02)
5. Maintain and enhance channel and floodway capacity (G02)
6. Maintain and enhance flood routing characteristics to maintain the current level of risk or reduce the risk of flooding (G02)

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7. Operate the project in a manner consistent with the flood flow releases required in the Corps manual (G02)
8. Minimize and mitigate adverse project impacts resulting from altered flow regimes (G05)
9. Return as far as is practicable to natural sedimentation and scour regime in the river below the dam (G05)

Key Results/Information:

- No key results have been obtained to date in the Feather River from modeling efforts or field surveys.
- Some substrate areas in low-flow reach have armoring and winnowing of fines from lack of gravel recruitment.

Data Available:

- Habitat cross-sections for PHABSIM analysis completed (SP-G2).

Data Forthcoming:

- Mapping of spawning gravel deposits (SP-G2)
- Sediment transport sampling (SP-G2)
- Bank erosion analysis (SP-G2)
- SP-F16 will provide data on available instream flows and spawning suitability for anadromous fish species.

Potential Resource Actions: (assuming gravel quantity and quality is considered a limiting factor)

- FR-50. Supplement existing armored gravel in low-flow reach with suitable spawning gravel to increase productivity (i.e., # fish produced per unit area). This option likely would require continued gravel supplementation over time. Spawning gravel could be obtained from the OWA.
- FR-51. Increase quantity of shallow water rearing habitat in the low flow section of Feather River from higher flows. This Resource Action is designed to increase habitat in the low flow section because increased flows would cover existing riparian vegetation.
- FR-52. Create levy setbacks to increase meandering nature of river and improve gravel composition in critical spawning reaches of the low-flow reach.
- FR-53. Dredge low-flow channel to improve spawning gravel composition.
- FR-54. Modify channel slope to create more side-channel habitat for salmonid rearing.
- FR-55. Gravel replacement in the low flow section at spawning riffles if these areas are found to be of poor spawning quality.

3.0 THERMALITO COMPLEX AND THE OROVILLE WILDLIFE AREA

3.1 DESCRIPTION OF GEOGRAPHIC UNITS

This effort is directed to the environmental resources downstream of Oroville Dam and reservoir and includes the following:

1. Thermalito Complex
 - a. Thermalito Diversion Pool
 - b. Thermalito Forebay
 - c. Thermalito Afterbay
2. Oroville Wildlife Area (OWA)
 - a. Exclusive of the Feather River

3.2 GEOGRAPHIC BASIS FOR DISCUSSION

In addition to structuring by resource area, discussion of potential Resource Actions for Oroville relicensing is best addressed on a geographic basis. The geographic basis has several advantages: (1) provide consistency with study that plans were developed within a geographic framework; (2) allow integration and evaluation of potential Resource Actions across geographic areas; and (3) cross resource issues can more easily be identified on a geographic basis. The Geographic Units within the Thermalito Complex and Oroville Wildlife Area are described below.

3.3 DISCUSSION OF AQUATIC BIOLOGICAL RESOURCES

3.3.1 THERMALITO COMPLEX

The Thermalito Complex includes the Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay.

3.3.1.1 Fish Passage

Resource Goals:

1. Minimize and mitigate adverse project related effects on the passage of resident fish (F04)
2. Enhance passage of resident fish (F04)
3. Provide for upstream passage of anadromous fish (F15)

Key Results/Information:

- A rainbow trout “put and take” fishery is present in the Thermalito Forebay.

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- It has been hypothesized that bass and other predatory fishes move through the Thermalito Afterbay to the lower Feather River and interact with migrating salmonids.

Data Available:

- A literature review released in February 2003 summarized predation management and monitoring studies and evaluated the success of potential protection, mitigation, and enhancement measures (SP-F21, Task 4). This literature review did not include field components specific to Oroville Facilities to assess predator movement through the Thermalito Complex.
- An interim report was issued in January 2003 with a literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2).

Data Forthcoming:

- SP-F3.1 will characterize fish composition and habitat and describe the impacts to fisheries resources from operation of the Thermalito Complex (SP-F3.1 Task 3-5).
- An upcoming report will identify potential predators of Feather River anadromous salmonids and describe key characteristics of their life history. A final report will be completed by December 2003 (SP-F21, Task 2).
- SP-F21 will produce estimates of losses to predation based on field experiments or predation models. A final report will be completed by December 2003 (SP-F21, Task 3).

Potential Resource Actions:

- TC-1. Install a device at the Thermalito Afterbay Outlet that will prevent downstream passage of planted fishes from the Thermalito Complex into the Feather River.
- TC-2. Install a fish counting device at the Thermalito Afterbay Outlet associated with a low-head dam to monitor all fish passage into the Feather River.

3.3.1.2 Aquatic Habitat

Resource Goals:

1. Enhance habitat for resident aquatic species (F03)
2. Enhance aquatic habitats through alteration of geomorphic processes (F06)
3. Minimize and mitigate adverse project impacts on habitat, genetic integrity and population size of anadromous fishes (F14)
4. Minimize and mitigate project impacts that harm aquatic habitats by altering geomorphic processes or degrading water quality (F06)
5. Minimize and mitigate adverse project effects on regional fisheries and habitat (F12)
6. Minimize and mitigate adverse project-related effects on anadromous fish passage and ecological functions (F15)

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7. Minimize or mitigate adverse project related effects on the habitat of resident fish (F03)
8. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)

Key Results/Information:

(Note: the following discussion focuses on the Thermalito Afterbay)

- Aquatic weeds could eliminate that quantity of open-water habitat for fish species in the Thermalito Afterbay.
- The Thermalito Afterbay can sustain warm and cold water fish species.

Data Available:

- An interim report was issued in January 2003 with a literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2).

Data Forthcoming:

- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects.
- SP-T7 will provide maps of current distribution of noxious species.

Potential Resource Actions:

- TC-3. Control aquatic weeds to enhance fish habitat in the Thermalito Afterbay. Aquatic weed control could be accomplished using various methods, including but not limited to mechanical control, chemicals, or altering the flows in the Thermalito Complex.
- TC-4. Provide habitat enhancement in areas without weeds, primarily through added structure, for warmwater or other target species in the Thermalito Afterbay.
- TC-5. Fill or reclaim Robinson Riffle Borrow Pond to provide additional side-channel habitat for native salmonids.
- TC-6. Manage water levels in the Thermalito Afterbay to provide increased habitat complexity for warmwater species. There are operational constraints, however, to how quickly the Thermalito Complex can decrease flows.

3.3.1.3 Flow and Water Temperature

Resource Goals:

1. Minimize and mitigate adverse project related effects on fish and aquatic resources (F01)
2. Minimize and mitigate adverse project effects on the physical, chemical, and biological integrity of water in Oroville Reservoir, its tributaries, and the Feather River (W03)

3. Ensure factors controllable by the project sustain the physical, chemical, and biological integrity of water in Oroville Reservoir, its tributaries, and the Feather River (W03)
4. Minimize fish disease through thermal regulation downstream from Oroville Dam (W11)
5. Ensure that water temperatures downstream from Oroville Dam are suitable for all beneficial uses during all hydrologic conditions (W12)
6. Maintain suitable water quality for beneficial uses in the Feather River downstream from the hatchery (W13)
7. Minimize and mitigate adverse project effects on water quality and temperature due to pump-back operations (W14)
8. Maintain suitable water quality and temperatures for fish and other aquatic resources in project waters (W14)

(Note: Only the most relevant goals related to aquatic resources and water quality are presented here; additional goals related to water quality are provided in Section 5.0 in this report.)

Key Results/Information:

- Pump-back generation in Thermalito Complex has the potential to affect water temperatures in the Thermalito Diversion Pool, Thermalito Forebay, and Thermalito Afterbay.

Data Available:

- Interim water quality is not available at this time.

Data Forthcoming:

- An interim report was issued in January 2003 with a literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2).
- Final report for Project operation on water temperature and the related effects on anadromous spawning adults in the Feather River. SP-F10 Task 3a is scheduled for completion in December 2003.

Potential Resource Actions:

- TC-7. Operate the Thermalito Complex to provide additional cold water in the low flow channel of the Feather River for benefit of salmonids.

3.3.1.4 Predation

Resource Goals:

1. Minimize adverse project impacts that increase predation pressure on salmonid and other species beyond natural or expected rates (F16)

Key Results/Information:

- There is a large concentration of predators in areas near the Thermalito Afterbay Outlet that have the potential to impact salmonid juveniles and other fishes in the Feather River.
- In addition to natural predators in the Feather River, it has been hypothesized that bass and other predatory species move through the Thermalito Afterbay to the lower Feather River and prey upon juvenile salmonids.
- Predatory fishes, particularly Sacramento pikeminnow, are generally more abundant downstream of the Thermalito Afterbay Outlet where summer water temperatures are warmer. Predator removal in other river systems have shown that other aquatic species can fill the niche left behind by removal of target species. Pikeminnow feeding has been shown to be positively correlated with increasing water temperature.

Data Available:

- A literature review released in February 2003 summarized predation management and monitoring studies and evaluated the success of potential protection, mitigation, and enhancement measures used in other aquatic systems (SP-F21, Task 4).
- An interim report was issued in January 2003 with a literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2).

Data Forthcoming:

- An upcoming report will identify potential predators of Feather River anadromous salmonids and describe main characteristics of their life history. A final report will be completed by December 2003 (SP-F21, Task 2).
- SP-F21 will produce estimates of losses to predation based on field experiments or predation models. A final report will be completed by December 2003 (SP-F21, Task 3).

Potential Resource Actions:

- TC-8. Evaluate current rainbow trout stocking program in Thermalito Forebay. This Resource Action may include the evaluation of the potential need for stocking non-susceptible *C. Shasta* and IHN fish in the Thermalito Complex.
- TC-9. Lower existing water temperatures at the Thermalito Afterbay Outlet for the purpose of reducing feeding rates for predators in the Feather River.

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3.3.1.5 Hatchery Operations and Disease

Resource Goals:

1. Minimize impact of stocked resident and introduced fish on wild salmonids (F03)
2. Minimize or eliminate adverse project related effects on fish due to diseases within project waters and project affected waters (F09)
3. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)
4. Minimize fish disease through thermal regulation downstream of Oroville Dam (W11)

Key Results/Information:

- There is connectivity between the Thermalito Forebay and Fish Barrier Pool.
- The Thermalito Forebay and Thermalito Afterbay managed similarly to OWA ponds as “managed fisheries”.
- No special status fish issues in the Thermalito Forebay or Thermalito Afterbay.
- Rainbow trout “put and take” fishery present in Thermalito Forebay.
- Thermalito Afterbay can sustain warm and cold water fish species.
- In the Thermalito Forebay and Afterbay, disease concerns may be present (*C. shasta*) and fluctuating water levels can force fish into sub-optimal habitat.

Data Available:

- Draft final report for effects of project operations on the fish diseases in the project area (SP-F2) completed in February 2003.

Data Forthcoming:

- Characterize fish composition and habitat, describe influence of project operations at the Thermalito Complex (SP-F3.1 Tasks 3 and 4).
- Effect of management plans on fish in the project area (SP-F5/7).
- Hatchery effects evaluation (SP-F9) will provide data on Feather River Hatchery operations, cohort analysis, densities in wild, and results of study on virulence of Feather River Type II-strain IHN. Final report will be completed in July 2004.
- Final report for Project operation on water temperature and the related effects on anadromous spawning adults in the Feather River. SP-F10 Task 3a is scheduled for completion in December 2003.

Potential Resource Actions:

- TC-10. Create salmonid stocking program in Afterbay similar to trophy program in Forebay.

3.3.2 OROVILLE WILDLIFE AREA

This area includes the Oroville Wildlife Area exclusive of the Feather River.

3.3.2.1 Aquatic Habitat

Resource Goals:

1. Enhance habitat for resident aquatic species (F03)
2. Enhance aquatic habitats through alteration of geomorphic processes (F06)
3. Minimize and mitigate adverse project impacts on habitat, genetic integrity and population size of anadromous fishes (F14)
4. Minimize and mitigate project impacts that harm aquatic habitats by altering geomorphic processes or degrading water quality (F06)
5. Minimize and mitigate adverse project effects on regional fisheries and habitat (F12)
6. Minimize and mitigate adverse project-related effects on anadromous fish passage and ecological functions (F15)
7. Minimize or mitigate adverse project related effects on the habitat of resident fish (F03)
8. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)

Key Results/Information:

- In some Oroville Wildlife Area (OWA) ponds, aquatic weeds eliminate the quantity of open-water habitat for fish species, including areas where salmonids may be stranded during high-flow events.

Data Available:

- Interim report issued January 2003 on life history and habitat requirements for Feather River fish species, including those salmonids with the potential to be stranded (SP-F3.2 Task 2 and SP-F21 Task 2).

Data Forthcoming:

- SP-T7 will include the distribution of noxious weeds in the Project area.
- SP-T4 will include the distribution of vegetation within the Oroville Wildlife Area.

Potential Resource Actions:

- TC-11. Control aquatic weeds in selected OWA ponds to improve fish habitat conditions. Aquatic weed control could be accomplished using various methods, including but not limited to mechanical control and chemicals in the OWA ponds.

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3.3.2.2 Hatchery Operations and Disease

Resource Goals:

1. Minimize or eliminate adverse project related effects on fish due to diseases within project waters and project affected waters (F09)
2. Minimize impact of stocked resident and introduced fish on wild salmonids (F03)
3. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)
4. Minimize fish disease through thermal regulation downstream of Oroville Dam (W11)

Key Results/Information:

- OWA ponds considered “managed fisheries”.
- OWA ponds suitable habitat for warm-water species and some trout species.

Data Available:

- Draft final report for effects of project operations on the fish diseases in the project area (SP-F2) completed in February 2003. The evaluation of project operations on fish diseases may have applicability to potential Resource Actions that involve stocking fish in the Oroville Wildlife Area ponds.

Data Forthcoming:

- Characterize fish composition and habitat, describe influence of project operations at the Thermalito Complex (SP-F3.1 Task 5).
- Effect of management plans on fish in the project area (SP-F5/7).
- Hatchery effects evaluation (SP-F9) will provide data on Feather River Hatchery operations, cohort analysis, densities in wild, and results of study on virulence of Feather River Type II-strain IHN. Final report will be completed in July 2004. The evaluation of hatchery operations may have applicability to potential Resource Actions that involve stocking fish in the Oroville Wildlife Area ponds.
- Final report for Project operation on water temperature and the related effects on anadromous spawning adults in the Feather River. SP-F10 Task 3a is scheduled for completion in December 2003.

Potential Resource Actions:

- TC-12. Create trout stocking program in suitable OWA ponds. Program would operate seasonally and all stocked fish would be screened for disease.
- TC-13. Stock warmwater species (e.g., Florida strain bass) in selected OWA ponds to create trophy angling areas.

3.4 DISCUSSION OF TERRESTRIAL RESOURCES

3.4.1 THERMALITO COMPLEX

3.4.1.1 Terrestrial Habitat

Resource Goals:

1. Development of coordinated interagency wildlife management plan(s) for lands within the project boundary which promote wildlife species diversity, population of sensitive wildlife species, and recreationally/commercially important species (T06)
2. Minimize negative impacts to wildlife habitat through fire and fuel load management practices to enhance public safety (sensitive to wildlife habitat) (T11)
3. Enhance upland habitat on project lands (T10)
4. Minimize and mitigate project-related effects on upland habitat (T05)
5. Enhance riparian and wetland habitats including floodplain and upland wetlands, vernal pools, and brood ponds within the project boundary (T05)
6. Restore disturbed sites with native plant communities (T07)
7. Minimize and mitigate adverse project-related effects on levee bound floodplain and soil stability, wildlife habitat, native plant communities and project water fluctuation (T03)
8. Minimize and mitigate project-related recreation impacts on wildlife and plant communities (T09)
9. Enhance nesting and wintering Pacific Flyway waterfowl and plant communities (T09)
10. Identify fire prevention management practices to help reduce damage from fires to natural and man-made resources and enhance habitat diversity (T11)

Key Results/Information:

- Presence of valley elderberry longhorn beetle (VELB) and Swainson's hawk in the Thermalito Complex. The western yellow-billed cuckoo can potentially occur in the Thermalito Complex.
- Ducklings use exposed mudflats/experimental wetland areas in Thermalito Afterbay during April and May.
- Likely minor impacts on the movement of wildlife due to recreation.

Data Available:

- Final results are not available at this time.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.

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- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T6 will generate a wildlife management plan for lands within the Project area. An interim report is scheduled for August 2003 and a final report is due in December 2004.
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.

Potential Resource Actions:

- TC-14. Modify recreational use patterns in the Thermalito Complex to minimize impacts to important terrestrial species (exact measures dependent on analysis in upcoming report).
- TC-15. Provide improved native vegetation cover and screening within important corridors.
- TC-16. Add more brood ponds to accommodate migrating waterfowl in the Thermalito Afterbay
- TC-17. Provide native upland cover enhancement in the vicinity of the Thermalito Afterbay for the benefit of migrating waterfowl. Upland cover enhancement can provide higher nesting densities (2-3 nests/acre) for waterfowl than current brood ponds. Irrigation of installed upland cover would need to be addressed.

3.4.1.2 Riparian

Resource Goals:

1. Minimize and mitigate adverse project related effects on riparian and wetland ecosystems along the Feather River (T05)
2. Enhance riparian and wetland habitats including floodplain and upland wetlands, vernal pools, and brood ponds within the project boundary (T05)

Key Results/Information:

- Limited habitat use along Forebay due to high recreation levels; and limited wetland habitat.
- Ducklings use exposed mudflats/experimental wetland areas in Thermalito Afterbay during April and May.

Data Available:

- Final results are not available.

Data Forthcoming:

- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland

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communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.

- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.

Potential Resource Actions:

TC-18. Develop management protocols to avoid maintenance/operational impacts on wetlands.

TC-19. Initiate active native vegetation plantings in Thermalito Afterbay area.

TC-20. Maintain brood ponds and constant elevations during spring breeding season.

3.4.1.3 Non-Native Plant Species

Resource Goals:

1. Minimize and mitigate project-related effects on the dispersal of noxious weeds (T07)
2. Control noxious weeds of greatest ecological and agricultural concern (T07)
3. Remove undesirable non-native plant species around Lake Oroville, Feather River, Thermalito Forebay, and Thermalito Afterbay areas, especially star thistle, tree of heaven, and other invasive plant species (T07)
4. Restore disturbed sites with native plant communities (T07)
5. Minimize and mitigate project-related effects on dispersal of noxious aquatic weeds into downstream irrigation canals (T07)

Key Results/Information:

- Star thistle and purple loosestrife are present in the Thermalito Complex.

Data Available:

- Final results are not available at this time.

Data Forthcoming:

- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T7 will provide maps of the current distribution of noxious species in the project area. A report is scheduled for release in Fall 2003.

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- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

Potential Resource Actions:

- TC-21. Eliminate noxious plants via herbicidal treatment or mechanical control and restore with native species (may require continued maintenance due to periodic high-flow events). Other techniques not mentioned also may be used to control noxious plants.
- TC-22. Develop construction and recreational management protocols to control the spread of noxious species.
- TC-23. Develop a flow regime to control exotic and noxious plant species.

3.4.1.5 Threatened and Endangered Wildlife and Plant Species

Resource Goals:

1. Enhance wildlife and wildlife habitat within the FERC project boundary (T01)
2. Minimize and mitigate project-related impacts on wildlife and wildlife habitat (T01)
3. Minimize and mitigate adverse project effects on special status plant and animal species (T02)
4. Promote the expansion of sensitive species (T02)
5. Minimize and mitigate adverse project-related effects on riparian and wetland ecosystems along the Feather River (T05)
6. Enhance vegetation and wildlife habitat within the levee bound floodplain and project water fluctuation zone (T03)
7. Minimize and mitigate adverse project-related effects on plant and wildlife species diversity (T04)
8. Maintain viable populations of all native species with emphasis on sensitive species (T04)
9. Maintain viable populations of desirable non-native animal species (T04)
10. Minimize and mitigate adverse project-related effects on biodiversity and ecosystem health (T04)
11. Enhance biodiversity and ecosystem health and stability (T04)

Key Results/Information:

- Valley elderberry longhorn beetle (VELB) and Swainson's hawk are present in the Thermalito Complex. The western yellow-billed cuckoo can potentially occur in the Thermalito Complex.
- Numerous vernal pools and ephemeral swales occur throughout the Thermalito Afterbay area. Five of seven federally- and State-listed plant species have potential to occur in the Afterbay. Four of these are summer annuals (Hoover's Spurge, hairy Orcutt grass, slender Orcutt grass, and Greene's tuctoria. The fifth species flowers in March to May and is the Butte County meadowfoam. No listed

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species have been found in vernal pool habitat to date; further field surveys are scheduled for spring 2003 (SP-T2).

- Emergent vegetation bands surrounding the Thermalito Afterbay have the potential to support a number of species of concern that are present during late summer (Sanford's arrowhead, four-angled spikerush, and rose-mallow). This area does not have the potential to support federally- or State-listed plant species (SP-T2).
- Ducklings use exposed mudflats/experimental wetland areas in Thermalito Afterbay during April-May.

Data Available:

- Progress summary for SP-T2 released in December 2002. This report includes a review of literature for threatened, endangered and special status plants in the Thermalito Afterbay and preliminary reports from field surveys.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T6 will generate a wildlife management plan for lands within the Project area. An interim report is scheduled for August 2003 and a final report is due in December 2004.
- SP-T7 will provide maps of the current distribution of noxious species in the project area. A report is scheduled for release in Fall 2003.
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.
- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

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Potential Resource Actions:

- TC-24. Develop maintenance and recreational management protocols to avoid impact to special status species within the Thermalito Complex. Specific measures associated with this Resource Action are not identified at this time.
- TC-25. Provide native upland cover enhancement in the vicinity of the Thermalito Afterbay for the benefit of migrating waterfowl. Upland cover enhancement can provide higher nesting densities (2-3 nests/acre) for waterfowl than current brood ponds. Irrigation of installed upland cover would need to be addressed.

3.4.2 OROVILLE WILDLIFE AREA

3.4.2.1 Terrestrial Habitat

Resource Goals:

1. Development of coordinated interagency wildlife management plan(s) for lands within the project boundary which promote wildlife species diversity, population of sensitive wildlife species, and recreationally/commercially important species (T06)
2. Minimize negative impacts to wildlife habitat through fire and fuel load management practices to enhance public safety (sensitive to wildlife habitat) (T11)
3. Enhance upland habitat on project lands (T10)
4. Minimize and mitigate project-related effects on upland habitat (T05)
5. Enhance riparian and wetland habitats including floodplain and upland wetlands, vernal pools, and brood ponds within the project boundary (T05)
6. Restore disturbed sites with native plant communities (T07)
7. Minimize and mitigate adverse project-related effects on levee bound floodplain and soil stability, wildlife habitat, native plant communities and project water fluctuation (T03)
8. Minimize and mitigate project-related recreation impacts on wildlife and plant communities (T09)
9. Enhance nesting and wintering Pacific Flyway waterfowl and plant communities (T09)
10. Identify fire prevention management practices to help reduce damage from fires to natural and man-made resources and enhance habitat diversity (T11)

Key Results/Information:

- Likely minor impacts on the movement of wildlife due to recreation.
- Presence of western yellow-billed cuckoo (potentially), valley elderberry, longhorn beetle (VELB), Swainson's hawk, and bank swallow.
- Gravel piles may present barriers to migration or dispersal of terrestrial species.

Data Available:

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- Final results are not available at this time.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T6 will generate a wildlife management plan for lands within the Project area. An interim report is scheduled for August 2003 and a final report is due in December 2004.
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.

Potential Resource Actions:

TC-26. Modify recreational use within the OWA to minimize impacts to important terrestrial species (exact measures dependent on analysis in upcoming report).

TC-27. Provide improved native vegetation cover and screening within important corridors.

TC-28. Develop hydrologic regime to foster the establishment of native riparian vegetation (e.g., determine duration and frequency for cottonwood establishment in terraced areas).

3.4.2.2 Non-Native Plant Species

Resource Goals:

1. Minimize and mitigate project-related effects on the dispersal of noxious weeds (T07)
2. Incorporate project lands in countywide mapping process of noxious weeds (T07)
3. Control noxious weeds of greatest ecological and agricultural concern (T07)
4. Remove undesirable non-native plant species around Lake Oroville, Feather River, Thermalito Forebay, and Thermalito Afterbay areas, especially star thistle, aianthus, and other invasive plant species (T07)
5. Restore disturbed sites with native plant communities (T07)

Key Results/Information:

- Star thistle and purple loosestrife are present in the OWA.

Data Available:

- Final results are not available at this time.

Data Forthcoming:

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- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T7 will provide maps of the current distribution of noxious species in the project area. A report is scheduled for release in Fall 2003.
- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

Potential Resource Actions:

- TC-29. Eliminate noxious plants via herbicidal treatment or mechanical control (may require continued maintenance due to periodic high-flow events). Other techniques not mentioned may be used to control plants.
- TC-30. Develop construction and recreational management protocols to control the spread of noxious species.
- TC-31. Develop hydrologic regime to foster the establishment of native riparian vegetation.

3.4.2.3 Threatened and Endangered Wildlife and Plant Species

Resource Goals:

1. Enhance wildlife and wildlife habitat within the FERC project boundary (T01)
2. Minimize and mitigate project-related impacts on wildlife and wildlife habitat (T01)
3. Minimize and mitigate adverse project effects on special status plant and animal species (T02)
4. Promote the expansion of sensitive species (T02)
5. Minimize and mitigate adverse project-related effects on riparian and wetland ecosystems along the Feather River (T05)
6. Enhance vegetation and wildlife habitat within the levee bound floodplain and project water fluctuation zone (T03)
7. Minimize and mitigate adverse project-related effects on plant and wildlife species diversity (T04)
8. Maintain viable populations of all native species with emphasis on sensitive species (T04)
9. Maintain viable populations of desirable non-native animal species (T04)
10. Minimize and mitigate adverse project-related effects on biodiversity and ecosystem health (T04)
11. Enhance biodiversity and ecosystem health and stability (T04)

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Key Results/Information:

- Valley elderberry longhorn beetle (VELB) and Swanson's hawk are in the Oroville Wildlife Area. The western yellow-billed cuckoo can potentially occur in the Oroville Wildlife Area.
- A number of ponds in the Oroville Wildlife Area potentially support special status plant species. A number of large populations of four-angled spikerush have been found in this area. No ponds have habitat that would support any of the federally- or State-listed plant species (SP-T2). Further field surveys are planned for Spring 2003.

Data Available:

- Progress summary for SP-T2 released in December 2002. This report includes a review of literature for threatened, endangered and special status plants in the Oroville Wildlife Area and preliminary reports from field surveys.

Data Forthcoming:

- SP-T1 will identify project-related effects on sensitive, threatened or endangered wildlife species and wildlife habitat in the project area, including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T6 will generate a wildlife management plan for lands within the Project area. An interim report is scheduled for August 2003 and a final report is due in December 2004.
- SP-T7 will provide maps of the current distribution of noxious species in the project area. A report is scheduled for release in Fall 2003.
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.
- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

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Potential Resource Actions:

TC-32. Enhance or add riparian habitat for threatened, endangered, or special status species in the Oroville Wildlife Area. This Resource Action may require continued maintenance due to periodic high-flow events. Specific locations within the OWA are not listed at this time. The addition of riparian habitat may require land acquisition.

TC-33. Develop maintenance and recreational management protocols to avoid impacts to threatened, endangered, or special status species within the OWA. Specific measures associated with this Resource Action are not identified at this time.

3.5 DISCUSSION OF GEOMORPHOLOGY

3.5.1 OROVILLE WILDLIFE AREA

3.5.1.1 Stream/Floodplain Connectivity

Resource Goals:

1. Minimize and mitigate adverse project impacts to the extent feasible on natural geomorphic processes in the downstream reaches (G01)
2. Maintain and enhance or increase aquatic and terrestrial habitat (G01)
3. Minimize project impacts on the erosion of downstream properties and resources of statewide significance (as defined in CEQA) (G01)
4. Maintain channel design capacity and reduce the risk of flooding (G02)
5. Maintain and enhance channel and floodway capacity (G02)
6. Maintain and enhance flood routing characteristics to maintain the current level of risk or reduce the risk of flooding (G02)
7. Operate the project in a manner consistent with the floodflow releases required in the Corps manual (G02)
8. Minimize and mitigate adverse project impacts resulting from altered flow regimes (G05)
9. Return as far as is practicable to natural sedimentation and scour regime in the river below the dam (G05)

Key Results/Information:

- Porous nature of gravels allows groundwater to feed many of the Oroville Wildlife Area ponds with freshwater.
- Periodic high-flow events in Feather River inundate some Oroville Wildlife Area ponds.

Data Available:

- Inventory of existing wells and current groundwater monitoring activities released January 2003 (SP-W5, Task 1, Phase 1).

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Data Forthcoming:

- The hydrologic connection between the Feather River and groundwater in the vicinity of the Oroville Wildlife Area will be detailed in SP-W5. The final report is scheduled for Spring 2005, with periodic draft reports prior to this date.

Potential Resource Actions:

- TC-34. Increase floodplain connectivity between OWA and mainstem Feather River with the goal of increasing inflow to selected OWA ponds during higher flows.

4.0 LAKE OROVILLE AND UPSTREAM TRIBUTARIES

4.1 GEOGRAPHIC BASIS FOR DISCUSSION

In addition to structuring by resource area, discussion of potential Resource Actions for Oroville relicensing is best addressed on a geographic basis. The geographic basis has several advantages: (1) provide consistency with the study plans that were developed within a geographic framework; (2) allow integration and evaluation of potential Resource Actions across geographic areas; and (3) cross-resource issues can more easily be identified on a geographic basis. The Geographic Units within the Lake Oroville area are described below.

4.2 DESCRIPTION OF GEOGRAPHIC UNITS

This effort is directed to the environmental resources upstream of Oroville Dam and reservoir and includes the following:

1. Lake Oroville
2. Upstream tributaries within the project boundary
 - a) North Fork Feather River
 - b) Middle Fork Feather River
 - c) South Fork Feather River
 - d) West Branch

4.3 DISCUSSION OF AQUATIC BIOLOGICAL RESOURCES

4.3.1 LAKE OROVILLE

The Lake Oroville area includes the reservoir and the mouths of upstream tributaries from the reservoir to the high water mark.

4.3.1.1 Drawdown

Resource Goals:

1. Provide cold- and warm-water fisheries sufficient to support desired recreational and commercial fisheries (F01)
2. Minimize and mitigate adverse project related effects on a balanced warm and cold water fishery (F05)
3. Provide a balanced warm and cold water fishery F05)
4. Minimize and mitigate adverse project effects on interactions between lake and tributary fish populations (F07)
5. Enhance lake fisheries (F07)

Key Results/Information:

- Lake drawdown during spawning season potentially dewater bass nests.
- Lake drawdown potentially reduces the available habitat and alters the distribution of cold- and warm-water fisheries in Lake Oroville.

Data Available:

- Current data suggests that reservoir drawdowns greater than nine feet per month can result in nest exposure (Lee 1979).
- An interim report was issued in January 2003 with a literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2) and includes fish species upstream of Oroville Dam.

Data Forthcoming:

- SP-F3.1 will provide information on the project effects to fish and their habitat in Lake Oroville (Tasks 1 and 2). Interim and Final reports for subtasks are anticipated in summer and late-fall 2003.

Potential Resource Actions:

- LO-1. Regulate reservoir drawdowns to reduce nest stranding and subsequent mortality of bass species.

4.3.1.2 Fish Stocking and Disease

Resource Goals:

1. Minimize impact of stocked resident and introduced fish on resident fish (F03)
2. Minimize or eliminate adverse project related effects on fish due to diseases within project waters and project affected waters (F02)
3. Initiate efforts to minimize or eliminate adverse project related effects on IHN within project waters, and project affected waters prior to license application submittal (F02)
4. Minimize the effects of non-endemic pathogens carried by anadromous fish transported to the upper watershed (F09)

Key Results/Information:

- Lake Oroville can sustain warm and cold water fish species.
- Disease concerns may be present (*C. shasta* and IHN)
- Fluctuating water levels can force fish into sub-optimal habitat.
- Existing cold water fishery robust and successful with anglers.

Data Available:

- Draft final report for effects of project operations on the fish diseases in the project area (SP-F2) completed in March 2003.
- DWR Fish Stocking Reports are available.

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Data Forthcoming:

- Characterize fish composition and habitat, describe influence of project operations at Lake Oroville (SP-F3.1, Tasks 1 and 2).
- Effect of management plans on fish in the project area (SP-F5/7).
- Hatchery effects evaluation (SP-F9) will provide data on Feather River Hatchery operations, cohort analysis, densities in wild, and results of study on virulence of Feather River Type II-strain IHN. Final report will be completed in July 2004.
- SP-F15 will provide information on the warmwater fishery in Lake Oroville and provide a feasibility analysis of anadromous fish passage past Oroville Dam.

Potential Resource Actions:

- LO-2. Continue to evaluate fish stocking in Lake Oroville for disease concerns.
- LO-3. Develop management protocols for the coldwater fishery upstream of Lake Oroville as well as in the reservoir.

4.3.1.3 Aquatic Habitat

Resource Goals:

1. Enhance habitat for resident aquatic species (F03)
2. Enhance aquatic habitats through alteration of geomorphic processes (F06)
3. Minimize and mitigate adverse project impacts on habitat, genetic integrity and population size of anadromous fishes (F14)
4. Minimize and mitigate project impacts that harm aquatic habitats by altering geomorphic processes or degrading water quality (F06)
5. Minimize and mitigate adverse project effects on regional fisheries and habitat (F12)
6. Minimize and mitigate adverse project-related effects on anadromous fish passage and ecological functions (F15)
7. Minimize or mitigate adverse project related effects on the habitat of resident fish (F03)
8. Continued mitigation for loss of anadromous fish spawning habitat in the Feather River (F09)

Key Results/Information:

- Lake drawdown potentially strands bass nests.
- Lake drawdown potentially reduces the available habitat and alters the distribution of cold- and warm-water fisheries in Lake Oroville.

Data Available:

- An interim report was issued in January 2003 with a literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2) and includes fish species upstream of Oroville Dam.
- SP-F3.1 evaluates how the Lake Oroville water surface elevation reductions might impact bass spawning success (Task 2C).

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- Annual reports of Lake Oroville Fish Stocking and Fish Habitat Improvements are available.

Data Forthcoming:

- SP-F3.1 will provide information on the project effects to fish and their habitat in Lake Oroville (Tasks 1 and 2). Interim and Final reports for subtasks are anticipated in summer and late-fall 2003.

Potential Resource Actions:

LO-4. Develop/modify habitat enhancement program for fish rearing/refuge in Lake Oroville through the placement of woody debris, Christmas tree reefs, or yet to be determined method. This Resource Action could include enhancement of spawning and nesting shelters for resident fish (bass and catfish) in the shallow areas of Lake Oroville. Habitat enhancement may incorporate the addition of old tires, riprap, concrete, or weighted pipes, or by adding rocky points or artificial reefs in the shallow areas of Lake Oroville. This Resource Actions is related to drawdown as locations for habitat improvement will need to take into account seasonal fluctuations of the reservoir.

4.3.2 UPSTREAM TRIBUTARIES

This area includes major tributaries within the project boundary exclusive of Lake Oroville.

4.3.2.1 Fish Passage

Resource Goals:

1. Minimize and mitigate adverse project related effects on the passage of resident fish (F04)
2. Enhance passage of resident fish (F04)
3. Provide for upstream passage of anadromous fish (F15)

Key Results/Information:

- A variety of man-made and natural barriers block fish passage in upstream tributaries to Lake Oroville. These barriers include Big Bend Dam on the North Fork Feather River, high stream gradients in the North Fork Feather River near Poe Reach, and sediment plugs that develop at the confluence of the tributaries with Lake Oroville.

Data Available:

- An interim report was issued in January 2003 with a literature review of life history and habitat requirements for Feather River fish species (SP-3.2 Task 2 and SP-F21 Task 2) and includes fish species upstream of Oroville Dam.

Data Forthcoming:

- SP-F3.1 will characterize fish composition and habitat and will describe the impacts to fisheries resources from operation of the Lake Oroville and upstream area within the project boundaries.

Potential Resource Actions:

- LO-5. Provide fish passage in the upstream tributaries (old dam at Big Bend, etc.) through the use of fish ladders, boulder removal, or other acceptable methods.
- LO-6. Remove sediment plugs and/or other barriers to provide native species access to upstream tributaries for spawning.
- LO-7. Remove Big Bend Dam, or repair the fish ladder to open up the Poe Reach.

4.3.2.2 Nutrient Transfer

Resource Goals:

1. Transfer of Energy and nutrients by anadromous fish migrations (F8)

Key Results/Information:

- Salmon are an important source of marine-derived nutrients for riverine ecosystems.

Data Available:

- No data is available at this time.

Data Forthcoming:

- SP-F8 will provide information on transfer of energy and nutrients by anadromous fish migrations. A draft report is anticipated in Summer 2003.
- SP-W1 will provide water quality information for Lake Oroville and upstream tributaries. A draft report is expected Summer 2003.

Potential Resource Actions:

- LO-8. Supplement tributaries with salmon carcasses or carcass analogs to restore nutrient levels in upstream tributaries (assuming nutrient concentrations are considered limiting factors).

4.4 DISCUSSION OF TERRESTRIAL RESOURCES

4.4.1 LAKE OROVILLE

The Lake Oroville area includes the reservoir and the mouths of upstream tributaries from the reservoir to the high water mark.

4.4.1.1 Upland Plant Communities

Resource Goals:

1. Enhance upland habitat on project lands (T10)
2. Minimize and mitigate project-related effects on upland habitat (T05)
3. Enhance riparian and wetland habitats including floodplain and upland wetlands, vernal pools, and brood ponds within the project boundary (T05)
4. Restore disturbed sites with native plant communities (T07)
5. Minimize and mitigate project-related recreation impacts on wildlife and plant communities (T09)
6. Enhance nesting and wintering Pacific Flyway waterfowl and plant communities (T09)

Key Results/Information:

- No key results at this time.

Data Available:

- No reports are available at this time.

Data Forthcoming:

- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

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Potential Resource Actions:

- LO-9. Implement appropriate vegetation or restoration activities to enhance or restore native plant communities in the Lake Oroville upland areas.

4.4.1.2 Non-Native Wildlife

Resource Goals:

1. Development of coordinated interagency wildlife management plan(s) for lands within the project boundary which promote wildlife species diversity, population of sensitive wildlife species, and recreationally/commercially important species (T06)
2. Minimize and mitigate project-related recreation impacts on wildlife and plant communities (T09)

Key Results/Information:

- Nuisance non-native wildlife species are found in the vicinity of Lake Oroville recreational facilities.

Data Available:

- Final results are not available at this time.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T6 will generate a wildlife management plan for lands within the Project area. An interim report is scheduled for August 2003 and a final report is due in December 2004.
- SP-T8 will provide information on project effects on non-native wildlife. A list of species will be presented in the SP-T8 draft report anticipated in December 2003.
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.

Potential Resource Actions:

- LO-10. Retrofit existing Lake Oroville recreational facilities to remove potential food sources and nesting sites of non-native species and rodent refuge areas.

LO-11. Implement measures to reduce populations of nuisance non-native wildlife in the Lake Oroville areas.

4.4.1.3 Recreation and Wildlife

Resource Goals:

1. Development of coordinated interagency wildlife management plan(s) for lands within the project boundary which promote wildlife species diversity, population of sensitive wildlife species, and recreationally/commercially important species (T06)
2. Minimize and mitigate project-related recreation impacts on wildlife and plant communities (T09)
3. Enhance nesting and wintering Pacific Flyway waterfowl and plant communities (T09)

Key Results/Information:

- No key results are available at this time.

Data Available:

- Reports are not available at this time.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T6 will generate a wildlife management plan for lands within the Project area. An interim report is scheduled for August 2003 and a final report is due in December 2004.
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.

Potential Resource Actions:

LO-12. Implement measures to reduce recreational disturbances on wildlife populations as need based on the results of study plan SP-T9.

4.4.1.4 Special Status Species

Resource Goals:

1. Enhance wildlife and wildlife habitat within the FERC project boundary (T01)

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2. Minimize and mitigate project-related impacts on wildlife and wildlife habitat (T01)
3. Minimize and mitigate adverse project effects on special status plant and animal species (T02)
4. Promote the expansion of sensitive species (T02)
5. Minimize and mitigate adverse project-related effects on riparian and wetland ecosystems along the Feather River (T05)
6. Enhance vegetation and wildlife habitat within the levee bound floodplain and project water fluctuation zone (T03)
7. Minimize and mitigate adverse project-related effects on plant and wildlife species diversity (T04)
8. Maintain viable populations of all native species with emphasis on sensitive species (T04)
9. Maintain viable populations of desirable non-native animal species (T04)
10. Minimize and mitigate adverse project-related effects on biodiversity and ecosystem health (T04)
11. Enhance biodiversity and ecosystem health and stability (T04)

Key Results/Information:

- No key results are available at this time.

Data Available:

- Reports are not available at this time.

Data Forthcoming:

- SP-T1 will identify project-related effects on wildlife habitat including habitat loss or fragmentation. A summary report is scheduled for Summer 2003. The final report is scheduled for completion by early 2004.
- Final report for SP-T2 will identify threatened, endangered, or special status plant and wildlife species in the Thermalito Complex and assess potential project impacts. This report is anticipated in early 2004.
- SP-T3/5 will provide data on wetland, riparian, and floodplain habitat conditions in the project area and will evaluate project-related impacts to wetland communities, hydrologic criteria, and habitats. Final report scheduled for Spring 2004.
- SP-T4 will provide vegetation mapping data, wildlife/habitat relationships, will identify high value and vulnerable habitats, as well as evaluate Project effects in the project area. A draft report is scheduled for release in Fall 2003 and a final report is anticipated in December 2003.
- SP-T6 will generate a wildlife management plan for lands within the Project area. An interim report is scheduled for August 2003 and a final report is due in December 2004.
- SP-T9 will provide information on recreation/wildlife conflicts and loss of habitat due to recreational activities and facilities in the project area. Draft and final reports are scheduled for release in early 2004.

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- SP-T10 will identify and evaluate project effects on upland plant communities in the project area, including appropriate opportunities for revegetation and/or restoration. Reports are scheduled for release in Fall 2003 and Spring 2004. A final report is expected in September 2004.

Potential Resource Actions:

- LO-13. Develop disturbance avoidance plans in the vicinity of nest sites during the nesting season of bald eagles and peregrine falcons.
- LO-14. Develop protection and avoidance protocols for sensitive plant populations in the Lake Oroville Area.

4.5 DISCUSSION OF GEOMORPHOLOGY

4.5.1 LAKE OROVILLE

4.5.1.1 Drawdown and Bank Erosion

Resource Goals:

1. Maintain and enhance or increase aquatic and terrestrial habitat (G01)
2. Minimize project impacts on the erosion of downstream properties and resources of statewide significance (as defined in CEQA) (G01)
3. Operate the project in a manner consistent with the floodflow releases required in the Corps manual (G02)

Key Results/Information:

- Periodic drawdown events in Lake Oroville have caused mass wasting in the vicinity of Lake Oroville.

Data Available:

- Data is not available at this time.

Data Forthcoming:

- Draft report of SP-G1 is scheduled for January 2004. This report will provide data on the channel morphology and geomorphology of stream reaches upstream of Lake Oroville.

Potential Resource Actions:

- LO-15. Stabilize target streams and reservoir banks to prevent mass wasting. The appropriate bank stabilization method has not yet been determined.

4.5.2 UPSTREAM TRIBUTARIES

4.5.2.1 Sediment Deposition

Resource Goals:

1. Maintain and enhance or increase aquatic and terrestrial habitat (G01)
2. Minimize project impacts on the erosion of downstream properties and resources of statewide significance (as defined in CEQA) (G01)
3. Maintain channel design capacity and reduce the risk of flooding (G02)
4. Maintain and enhance channel and floodway capacity (GG02)
5. Operate the project in a manner consistent with the floodflow releases required in the Corps manual (G02)

Key Results/Information:

- Landslides periodically deposit sediment into a reach of stream in the upper Middle Fork Feather River and create a migration barrier near Black Canyon.

Data Available:

- No results are available at this time.

Data Forthcoming:

- Draft report of SP-G1 is scheduled for January 2004. This report will provide data on the channel morphology and geomorphology of stream reaches upstream of Lake Oroville.

Potential Resource Actions:

- LO-16. Stabilize the hillslope near Black Canyon and remove sediment that has accumulated previously to re-open the stream for aquatic migration and fish passage.

4.6 DISCUSSION OF WATER QUALITY

Resource Actions to address water quality have not been identified at this time. Results from water quality sampling occurring as part of SP-W1 will be released in Summer 2003.

Appendix A

Table A-1. Draft Report - Resource Action Identifier and Environmental Work Group Resource Action Matrix Number Correlation Table.

Resource Action_ID	EWG_ID	Resource Action - Geographic Area and Potential Impact Addressed
FR-1	EWG-1	Low Flow Channel – Impaired Fish Passage
FR-2	EWG-2	Low Flow Channel – Impaired Fish Passage
FR-3	EWG-3	Low Flow Channel – Impaired Fish Passage
FR-4	EWG-13	High and Low Flow Channel – Limited Woody Debris Recruitment
FR-5	EWG-14	Low Flow Channel – Insufficient Holding Habitat for Adult Spring Chinook
FR-6	EWG-15	Low Flow Channel – Insufficient Spawning Habitat for Chinook and Steelhead
FR-7	EWG-16	Low Flow Channel – Insufficient Rearing Habitat for Juvenile Fish Species
FR-8	EWG-16	Low Flow Channel – Insufficient Rearing Habitat for Juvenile Fish Species
FR-9	EWG-17	Low Flow Channel – Insufficient Rearing Habitat for Juvenile Fish Species
FR-10	EWG-18	Low Flow Channel – Insufficient Spawning Habitat for Chinook and Steelhead
FR-11	EWG-40, 45, 48, 51	Low & High Flow Channel – Salmon Survival Related to Feather River Fish Hatchery
FR-12	EWG-41 EWG-44	Low Flow Channel – Over-Escapement Related to Hatchery Production
FR-13	EWG-42	Low Flow Channel – Genetic Integrity of Chinook Salmon
FR-14	EWG-34	Low Flow Channel – Predation on Juvenile Fish Species
FR-15	EWG-4	High Flow Channel – Impaired Fish Passage
FR-16	EWG-5	High Flow Channel – Impaired Fish Passage
FR-17	EWG-5	High Flow Channel – Impaired Fish Passage
FR-18	EWG-6	High Flow Channel – Impaired Fish Passage
FR-19	EWG-7	High Flow Channel – Impaired Fish Passage
FR-20	EWG-8	High Flow Channel – Impaired Fish Passage
FR-21	EWG-9	High Flow Channel – Impaired Fish Passage
FR-22	EWG-19	High Flow Channel – Insufficient Spawning Habitat
FR-23	EWG-13 EWG-20	High and Low Flow Channel – Limited Woody Debris Recruitment
FR-24	EWG-21	High Flow Channel – Insufficient Rearing Habitat for Juvenile Fish Species
FR-25	EWG-22	High Flow Channel – Insufficient Rearing Habitat for Juvenile

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		Fish Species
FR-26	EWG-23	High Flow Channel – Insufficient Rearing Habitat for Juvenile Fish Species
FR-27	EWG-24	High Flow Channel – Insufficient Rearing Habitat for Juvenile Fish Species
FR-28	EWG-25	High Flow Channel – Insufficient Rearing Habitat for Juvenile Fish Species
FR-29	EWG-36	High Flow Channel – Impaired Fish Passage
FR-30	EWG-43	High Flow Channel – Salmon Survival Related to Feather River Fish Hatchery
FR-31	EWG-41 EWG-44	Low Flow Channel – Over-Escapement Related to Hatchery Production
FR-32	EWG-42	Low Flow Channel – Genetic Integrity of Chinook Salmon
FR-33	EWG-53	Low Flow Channel – Insufficient Riparian Habitat
FR-34	EWG-54	Low Flow Channel – Insufficient Riparian Habitat
FR-35	EWG-55	Low Flow Channel – Insufficient Riparian Habitat
FR-36	EWG-56	Low Flow Channel – Terrestrial Impacts from Recreational Use
FR-37	EWG-72 EWG-76	Low Flow Channel – Proliferation of Non-Native Plants
FR-38	EWG-79 EWG-82	Low Flow Channel – Overall Impact to Threatened & Endangered Species
FR-39	EWG-64 EWG-69	Oroville Wildlife Area – Insufficient Riparian Habitat
FR-40	EWG-56	High Flow Channel – Terrestrial Impacts from Recreational Use
FR-41	EWG-57	High Flow Channel - Insufficient Wildlife Habitat
FR-42	EWG-72 EWG-76	High Flow Channel – Proliferation of Non-Native Plants
FR-43	EWG-73	High Flow Channel – Proliferation of Non-Native Plants
FR-44	EWG-74 EWG-77	High Flow Channel – Proliferation of Non-Native Plants
FR-45	EWG-80 EWG-83	High Flow Channel – Overall Impacts to Threatened & Endangered Species (also Oroville Wild life Area)
FR-46	EWG-86	Low Flow Area – Impaired Water Quality
FR-47	EWG-87	Low Flow Area – Impaired Water Quality
FR-48	EWG-88	Low Flow Area – Impaired Water Quality
FR-49	EWG-89	Low Flow Area – Impaired Water Quality
FR-50	EWG-91	Low Flow Area – Spawning Gravel Quantity
FR-51	EWG-92	Low Flow Area – Spawning Gravel Quantity
FR-52	EWG-93	Low Flow Area – Spawning Gravel Quantity
FR-53	EWG-94	Low Flow Area – Spawning Gravel Quantity
FR-54	EWG-96	Low Flow Area – Hydraulic Characteristics of Channel

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		Configuration
FR-55	EWG-95	Low Flow Area – Spawning Gravel Quantity
TC-1	EWG-10	Thermalito Complex – Passage of Stocked Fish into the Feather River
TC-2	EWG-11	Thermalito Complex – Passage of Stocked Fish into the Feather River
TC-3	EWG-26	Thermalito Complex – Proliferation of Aquatic Weeds (Include Oroville Wildlife Area)
TC-4	EWG-27	Thermalito Complex – Proliferation of Aquatic Weeds (Include Oroville Wildlife Area)
TC-5	EWG-28	Thermalito Complex – Insufficient Rearing Habitat for Juvenile Fish Species
TC-6	EWG-29	Thermalito Complex – Limited Habitat Complexity
TC-7	EWG-37	Thermalito Complex – Decreased Habitat Quality Related to Project Operations
TC-8	EWG-46	Thermalito Complex – Loss of Fish Production Related to Oroville Facilities
TC-9	EWG-35	Thermalito Complex – Predation of Juvenile Fish Species
TC-10	EWG-47	Thermalito Complex – Loss of Fish Production Related to Oroville Facilities
TC-11	EWG-26	Thermalito Complex – Proliferation of Aquatic Weeds (Include Oroville Wildlife Area)
TC-12	EWG-49	Oroville Wildlife Area - Loss of Fish Production Related to Oroville Facilities
TC-13	EWG-50	Oroville Wildlife Area - Loss of Fish Production Related to Oroville Facilities
TC-14	EWG-58	Thermalito Complex – Terrestrial Impacts from Recreational Use
TC-15	EWG-59	Thermalito Complex - Insufficient Wildlife Habitat
TC-16	EWG-60	Thermalito Complex – Loss of Habitat for Migrating Waterfowl
TC-17	EWG-61	Thermalito Complex – Loss of Habitat for Migrating Waterfowl
TC-18	EWG-64	Oroville Wildlife Area – Insufficient Riparian Habitat (also High Flow Channel)
TC-19	EWG-70	Thermalito Complex – Insufficient Riparian Habitat
TC-20	EWG-71	Thermalito Complex - Loss of Habitat for Migrating Waterfowl
TC-21	EWG-72 EWG-76	Thermalito Complex– Proliferation of Non-Native Plants
TC-22	EWG-74 EWG-77	High Flow Channel & Thermalito Complex – Proliferation of Non-Native Plants
TC-23	EWG-75	Thermalito Complex– Proliferation of Non-Native Plants
TC-24	EWG-80 EWG-83	Oroville Wildlife Area & High Flow Channel – Overall Impacts to Threatened & Endangered Species

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TC-25	EWG-81	Thermalito Complex– Overall Impacts to Threatened & Endangered Species
TC-26	EWG-62	Oroville Wildlife Area - Terrestrial Impacts from Recreational Use
TC-27	EWG-63	Oroville Wildlife Area - Insufficient Wildlife Habitat
TC-28	EWG-64	Oroville Wildlife Area – Insufficient Riparian Habitat (also High Flow Channel)
TC-29	EWG-72 EWG-76	Thermalito Complex– Proliferation of Non-Native Plants
TC-30	EWG-77	Oroville Wildlife Area – Proliferation of Non-Native Plants
TC-31	EWG-78	Oroville Wildlife Area – Proliferation of Non-Native Plants
TC-32	EWG-82	Oroville Wildlife Area – Overall Impacts to Threatened & Endangered Species
TC-33	EWG-83	Oroville Wildlife Area – Overall Impacts to Threatened & Endangered Species
TC-34	EWG-97	Oroville Wildlife Area – Hydraulic Characteristics of Channel Configuration
LO-1	EWG-31	Lake Oroville –Bass Nest Mortality
LO-2	EWG-40	Lake Oroville – Salmon Survival Related to Feather River Fish Hatchery
LO-3	EWG-52	Lake Oroville - Loss of Fish Production Related to Oroville Facilities
LO-4	EWG-32	Lake Oroville – Loss of Bass Habitat
LO-5	EWG-12	Upstream Tributaries – Impaired Fish Passage
LO-6	EWG-12	Upstream Tributaries – Impaired Fish Passage
LO-7	EWG-12	Upstream Tributaries – Impaired Fish Passage
LO-8	EWG-33	Upstream Tributaries – Potential Nutrient Limitation in Upper Tributaries
LO-9	EWG-65	Lake Oroville – Quantity of Upland Habitat
LO-10	EWG-66	Lake Oroville – Terrestrial Impacts from Recreation Use
LO-11	EWG-67	Lake Oroville – Terrestrial Impacts from Recreation Use
LO-12	EWG-68	Lake Oroville – Terrestrial Impacts from Recreation Use
LO-13	EWG-84	Lake Oroville – Overall Impacts to Threatened & Endangered Wildlife Species
LO-14	EWG-85	Lake Oroville – Overall Impacts to Threatened & Endangered Plant Species
LO-15	EWG-98	Lake Oroville – Erosion
LO-16	EWG-99	Upstream Tributaries – Erosion

Preliminary Information – Subject to Revision – For Collaborative Process Purposes Only